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THE PRINCIPLES and PRACTICE
of
OCULAR PHYSICAL THERAPY
for
OPTOMETRISTS
by
DR. JACK I. KURTZ

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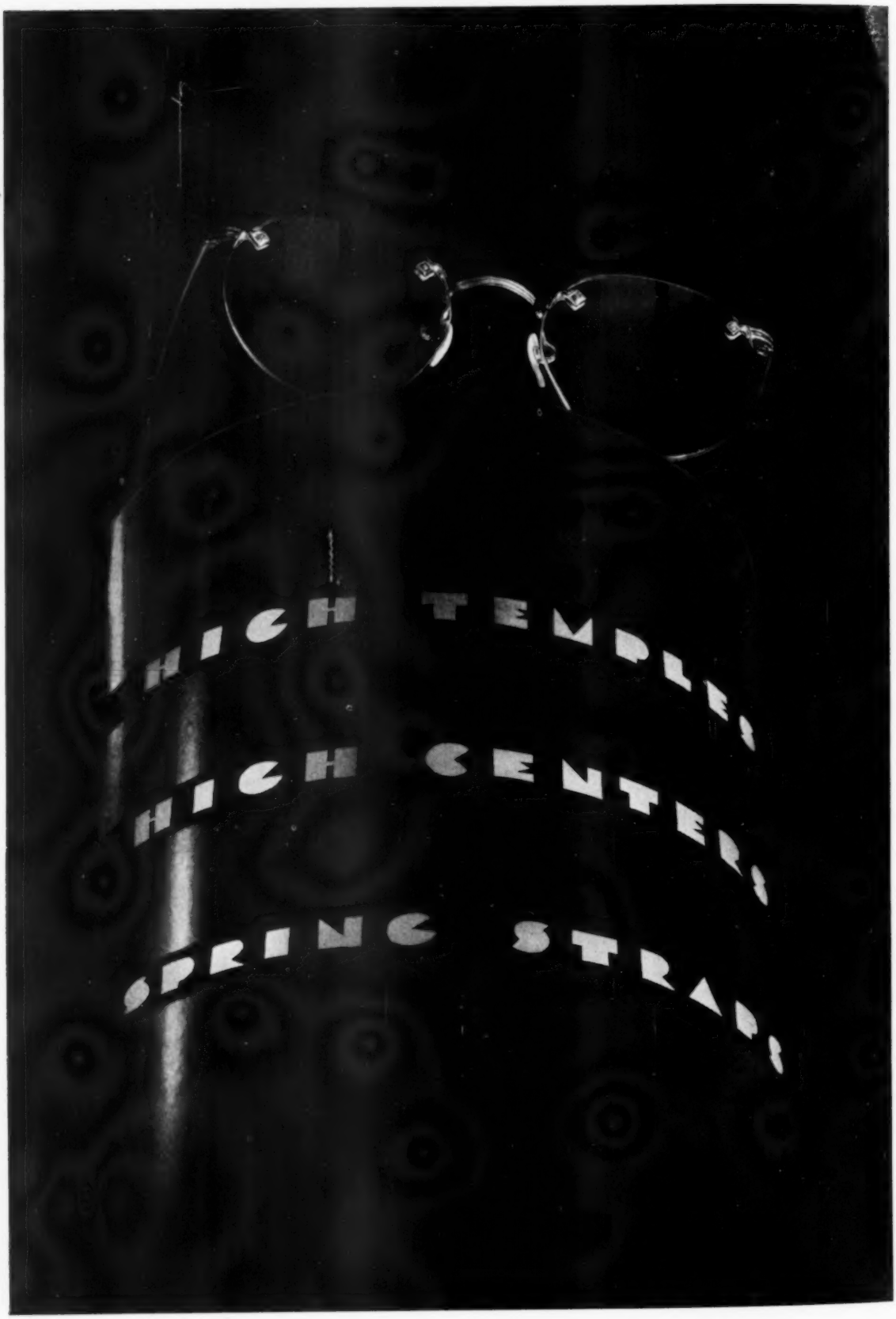

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AMERICAN JOURNAL OF OPTOMETRY

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A PRELIMINARY REPORT ON THE USE OF VISIBLE LIGHT IN THE CORRECTION OF REFRACTIVE AND MUSCULAR ABNORMALITIES*

Carel C. Koch, Opt. D., F. A. A. O.
Minneapolis, Minn.

The suggestion was hinted at by Spitler[1] before the American Academy of Optometry at Omaha in December of 1930, that the use of certain portions of the visible spectrum might conceivably be of value in solving some of our optometric problems, particularly with reference to certain ocular physiologic changes. At that time the writer understood, in a sense, what Spitler was driving at, but knew of no practical method in which his ideas could be applied. Shortly after this, Loeb[2] suggested to Kurtz and myself that we use one of his lamps in experimental work on certain ocular conditions to see just what the effect of the use of visible radiation, using certain limited portions of the visible spectrum, would have upon these selected cases.

Naturally experimental work of this character in private practice is somewhat difficult. In the first place patients present themselves, not to be experimented upon but rather to be relieved of certain specific symptoms and this must be done in a reasonably short time. Few persons are willing to return, time after time, for seemingly endless check tests, which had to be made, both before and after each use of the lamp. In addition to this, many who agreed to assist found other things interfering and their interest waned, with the result that they failed to return and thus the data which was started was of little or no value, due to the inability of the subject to finish the experiment.

The types of cases which the writer decided to experiment with,

*An abridgement of the material presented before the American Academy of Optometry at Chicago, December 18, 1932.

[1]H. R. Spitler. The Optical Control of the Central Gray. American Journal of Optometry. Vol. 9, No. 11, pp. 403-411. 1932. Spitler says in part—"At present, legally and by birthright, optometry consists of the proper preparation of light within the so-called visible range. Therein at present lies its field, and that field is so full of possibilities that the writer (Spitler) hardly knows just where to begin with a presentation of the subject.—And keep in mind this one fact, that any physiological reaction mentioned are obtainable by use of light within the so-called visible ranges, and that all applications were made through the eyes."

[2]Dr. Carl Loeb, c/o Actino Laboratories, Inc., 800 North Clark St., Chicago, Ill.

were first: Cases of pseudo-myopia or cases of suspected pseudo-myopia. Second: Cases of hyperopia in which the large percentage of the error was latent. Third: Cases of high esophoria, particularly in young patients between the ages of 14 and 22, and Fourth: Cases of excessively large amounts of hyperopia.

The experiments were carried on in the following manner. Each patient was carefully refracted and whatever initial measures necessary to relieve the immediate symptoms were prescribed. Following this a period of two weeks was allowed to pass so as to enable any upset unnatural condition due to the refraction and change of correction to subside and also to enable the patient to accustom himself or herself to the new correction. The patient, returning at the end of a two week period was again refracted, the findings of this second refraction representing the starting point of the experiment.

For example, in cases of pseudo-myopia or in cases of suspected pseudo-myopia the following refractive data was recorded both before and after the application of the lamp:

1. Uncorrected visual acuity.
2. Weakest correction giving normal vision.
3. Static skiametric findings.
4. Dynamic skiametric findings.

As far as the use of the lamp itself is concerned let me say that it is a carbon arc lamp using special impregnated carbons as a source of variable uncontrolled energy, these carbons made, to be rich in any particular spectral band the operator may wish to use. In front of the carbons is placed a glass filterer, so made as to permit the passage of only a specific band of the visible spectrum. There are a number of these giving the operator a possible choice of whatever group of color spectrum energy he may wish to use. The lamp is placed from 20 to 24 inches before the patient on level with his or her eyes, the proper filterer placed in its aperture for this purpose and the light turned on. The patient's eyes are open at all times and he or she is facing the lamp. After reading what little literature I could find on the subject we decided on treatment periods of from 7 to 10 minutes. In no case did I find this particularly distressing.

As the writer has had no previous experience with this technic it is obvious that the findings of the first group of cases handled by this method would suffer somewhat from the necessary changes in technic as new ideas presented themselves, and as old ones had to be discarded because of their impracticability. At first it was decided to use the entire spectral range as far as possible on each case and compare the results, but time being an element and as each case had to report at least twelve times on the use of each portion it will be seen that this was impractical. A re-reading of Loeb's monograph on this subject[3] finely determined

[3]C. Loeb. Handbook of Specific Light Therapy. Published by the Actino Laboratories, 190 North State St., Chicago, Ill. 82 pages. Illustrated.

my course of procedure and but three bands were chosen to use in these experiments.

Loeb in his work in this subject makes certain suggestions as to his beliefs as to the general physiological reactions produced by the use of certain specific bands. As there is practically nothing on this type of ocular work in his book and as no authorities were quoted nor were any technical references given it was impossible to check his findings on this subject. In addition to this there is nothing in medical or optometric literature on the subject, other than the article already mentioned, by Spitler and a mere mention of the subject by Kurtz.[4] Thus the entire matter was one of speculation. However, using the theories of Loeb as a starting point, the experiments were carried on.

As I have said, three bands or three sections of the visible spectrum were chosen, each to be used on each patient a given number of times with the results carefully checked. These portions of the spectrum used in my clinical experiments were as follows:

First, those particularly strong around 4,200 A. U. or blue-violet in color.

Second, those particularly strong around 5,500 A. U. or yellow-green in color.

Third, those particularly strong around 6,300 A. U. or red-orange in color.

Before going further it may be well to indicate first the reactions Loeb associates with the therapeutic use of these portions of the spectrum upon the system as a whole. He claims that the radiations around 4,200 A. U. (the blue-violet) have the effect of heart depressants and also have a depressant effect on the motor centers. The radiations around 5,500 A. U. (the yellow-green) have according to Loeb a sedative effect and those around 6,300 A. U. (the red-orange) have a stimulating effect on the sympathetic nervous system and the motor centers. Whether or not Loeb is correct, the writer cannot say. My experimental work in this field, covering about two years deals only with the use of spectroband[5] in ocular-neuro-muscular problems, an entirely new field of clinical research.

In giving the results of my clinical investigations I shall start with that group of cases which come under the heading of pseudo-myopia or suspected pseudo-myopia. During the two year period eight cases falling in this classification were treated. Of the eight only four were given a large number of treatments, the others for various reasons failing to continue the work to its possible conclusion. Of these eight cases, three seemed to derive some measure of benefit from the use of this type

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4J. I. Kurtz. Ocular Physical Therapy, p. 189. 1930.

5(The word "spectroband" has evidently been coined by users of visible radiant energy or color therapy to differentiate it from that type of therapy employed by those using invisible radiant energy such as ultra-violet for therapeutical purposes. This latter therapy is called actino therapy. The word "spectroband" is found in the writings of Loeb and Spitler, and others dealing with visible radiations.)—C. C. K.

of radiant visible energy. However, the number of cases treated is far too small to enable one to draw any conclusions from the results. It must be remembered that this is but a preliminary report covering but two years of work in private practice and is published, not because of the splendid success of the work, but rather to encourage others to attempt similar experimental work, thus more rapidly adding to our knowledge of the results, either good or negligible, which may come from the use of spectroband, in these cases of ocular-neuro-muscular involvements.

Pseudo-Myopia.

Case No. 3—Pseudo-Myopia. Patient, student, age 15, male. Patient decidedly of the bookworm type. Gets splendid marks in his studies and is a very fine violinist. He has made it a rule to practice several hours each day on his violin and when this is finished is usually found in his room either reading or working with a radio sending set which he has built himself. I go into detail here as this history of indoor activities has probably a bearing on the case. Most pseudo-myopic cases and for that matter most young myopic cases have similar histories. Patient came to me wearing —1.00 D. Sph. O. U. After these had been removed for ten minutes he had an uncorrected binocular visual acuity of 20/40 with difficulty. Corrected O. U., with a pair of —0.62 D. Sph. his vision was normal. Static skiametry indicated a myopia of one dioptre. His dynamic findings, however, after making deductions for accommodative lag showed a hyperopia of from one-half to three-quarters of a dioptre. He had a record of not being able to do near point work comfortably with his glasses on and his eyes were tired every afternoon. The glasses which he was using were gotten at the University Eye Clinic and had been prescribed with the aid of a mydriatic. Examinations further disclosed some 4^{Δ} of esophoria at 6 M., and 2^{Δ} of exophoria at 33 cm., both with and without correction. His case history, symptoms, dynamic findings and the esophoria indicated a pseudo-myopia and patient agreed to come to the office three afternoons each week to see if this could be corrected.

Prior to the first treatment I found the following conditions:

1. Uncorrected binocular V. A. = 20/40.
2. Weakest correction giving normal vision = O. U. —0.62 D. Sph.
3. Static skiametry O. U. — 1.00 D. Sph.
4. Dynamic skiametry O. U. + 0.50 D. Sph.

I first elected to use a spectroband wave, strong around 6,300 A. U. This was used for 7 minutes and the above findings again taken, with the following results:

1. Uncorrected binocular V. A. = 20/40 ???
2. Weakest correction giving normal vision = O. U. — 0.75 D. Sph.
3. Static skiametry O. U. — 1.00 D. Sph.
4. Dynamic skiametry O. U. + 0.25 D. Sph.

Twelve of these treatments were given during a month period, and at the end of this time the findings were as follows:

1. Uncorrected binocular V. A. = 20/50.
2. Weakest correction giving normal vision = O. U. — 0.87 D. Sph.
3. Static skiametry O. U. — 1.25 D. Sph.
4. Dynamic skiametry, O. U. plano.

This certainly was not an improvement, so the spectroband was changed from 6,300 A. U. to that one, strong around 5,500 A. U. At the end of nine treatments (three weeks) the findings were:

1. Uncorrected binocular V. A. = 20/40+.
2. Weakest correction giving normal vision = O. U. — 0.62 D. Sph.
3. Static skiametry O. U. 0.75 D. Sph.
4. Dynamic skiametry O. U. + 0.37 D. Sph.

Upon being asked whether or not he had altered the amount of near-point work he was doing he answered in the negative. Here was some improvement, so it was decided to continue the use of the same spectroband (5,500 A. U.) to see if further improvement could be made. At the end of eleven more treatments the findings were:

1. Uncorrected binocular V. A. = 20/24 ? ?
2. Weakest correction giving normal vision = O. U. — 0.25 D. Sph.
3. Static skiametry O. U. — 0.50 D. Sph.
4. Dynamic skiametry O. U. + 0.50 D. Sph.

At this point the patient was forced to discontinue treatments, his correction being changed to O. U. — 0.25 D. Sph. which he is now using. While I have not re-examined him, I have talked with him on the telephone and he assures me that he is comfortable and that his distance visual acuity is, in his belief at least, as good as it was when the treatments were stopped.

In case No. 3, the results of the use of spectroband, strong around 6,300 A. U., seemed to aggravate the condition, while the subsequent use of 5,500 A. U. seemed to improve it. It must be further understood that nothing in the way of prism-treatments or other forms of physical therapy was used. His correction was reduced from O. U. — 1.00 D. Sph. to O. U. — 0.62 D. Sph. at the start of the treatment work and this was later changed to O. U. — 0.25 D. Sph. at the end of the treatment period. All lamp treatments were for a period of 7 minutes which produced no noticeable discomfort on the part of the patient.

Case No. 9. Patient: girl nine years of age. Using O. U. — 0.75 D. Sph. Dynamic findings indicated a possible pseudo-myopic condition. I suggested treatments with visible radiant energy, deciding to use a spectroband strong around 5,500 A. U. Patient had six treatments with no noticeable results and was unable to come in longer.

Case No. 10, Patient: girl, eleven years of age. This patient needed — 1.00 D. Sph. in the right eye and — 1.50 D. Sph. in the left eye to get normal vision. This was prescribed along with treatments to see if any improvement could be made in vision by means of spectroband. The writer decided to start treatments on this patient using a spectroband, strong around 4,200 A. U. This was the first case of suspected pseudo-myopia that I had used this particular band of radiant energy upon. At the end of three weeks patient's parents were forced to discontinue sending her for treatments. There was no change in visual acuity but the static findings were a little higher than they were at the start of the treatment period. This patient had nine treatments, each for a seven minute period. There was no history of distress either during the treatment or after it. Obviously too few treatments were given in this case to permit one to draw any conclusions as to their value.

Case No. 16. Patient, boy, age eight. Patient came in with history of poor distance vision, this being but 20/50, O. U. School visual test findings were the first thing to make the parents suspect that his eyes were not quite normal. A pair of O. U. — 0.75 D. Sph. gave him normal vision. His static findings were about the same as the subjective and the dynamic skiametric tests indicated a hyperopia of 0.75 D. This indicated a pseudo-myopic condition although the near point phoria tests showed 6$^{\Delta}$ of exophoria. Patient's parents agreed to have him do no unnecessary near-point work for the next six months and treatments were started. The refractive findings at the beginning of the treatment period were:

1. Uncorrected binocular V. A. = 20/50 +.
2. Weakest correction giving normal vision = O. U. — 0.75 D. Sph. (It should be noted here however that no correction was prescribed.)
3. Static skiametry O. U. — 0.75 D. Sph.
4. Dynamic skiametry O. U. + 0.75 D. Sph.

I started the lamp treatments on this case using a 6,300 A. U. spectroband. Twelve treatments were given with this band of colored radiant energy with practically no change in the refractive findings. The spectroband was then changed to 4,200 A. U. At the end of twelve treatments with this band of colored radiant energy the findings were:

1. Uncorrected binocular V. A. = 20/40?
2. Weakest correction giving normal vision = O. U. — 0.62 D. Sph.
3. Static skiametry O. U. — 0.75 D. Sph.
4. Dynamic skiametry O. U. + 0.75 D. Sph.

The spectroband was then changed to 5,500 A. U. and twelve more treatments given. The results of the refractive findings at the end of this treatment period were:

1. Uncorrected binocular V. A. = 20/32.
2. Weakest correction giving normal vision = O. U. — 0.37 D. Sph.

3. Static skiametry O. U. — 0.62 D. Sph.
4. Dynamic skiametry O. U. + 0.87 D. Sph.

As the patient's vision had improved, the same treatments were continued for six more weeks. At the end of this period the findings were:

1. Uncorrected binocular V. A. = 20/24 with ease, of 20/20 with difficulty.
2. Weakest correction giving normal vision = plano.
3. Static skiametry O. U. — 0.50 D. Sph.
4. Dynamic skiametry O. U. + 1.00 D. Sph.

The treatments were discontinued at this point. He had had fifty-four spectroband treatments. Twelve with a band strong around 6,300 A. U. Then twelve more treatments with a band strong around 4,200 A. U. and finally thirty additional treatments with a band strong around 5,500 A. U. The treatment period using 6,300 A. U. seemed to accomplish nothing. That with 4,200 A. U. seemed to improve his condition a little and after the band had been changed to 5,500 A. U. the improvement seemed more rapid until practically normal vision had been reached.

Now the questions naturally arise:

(1) Would he have made the same progress and improvement had the order of the use of the various spectrobands been reversed?

(2) Did all improvement come from the use of the band, strong around 5,500 A. U.?

(3) Was the fact that the patient did less near-point work during this period a factor in the improvement as shown at the end of the period?

(4) Was the psychological effect of the treatment work responsible for the apparent success of the work?

I will not attempt to answer these questions now, but will continue with the report of other cases before discussing their findings.

Case 18. Patient: Male, age 16. Patient has an uncorrected visual acuity of 20/100. A pair of — 0.75 D. Sph. gave him a visual acuity of 20/32. This was the best visual acuity he could get. Patient has a history of inability to do close work and has had no satisfaction with glasses. Patient has 3$^{\Delta}$ of esophoria at 33 cm and 18$^{\Delta}$ of esophoria at 6 meters. No correction was prescribed and treatments were decided upon. Because of some previous success with spectroband, strong around 5,500 A. U. in these cases of pseudo-myopia, I decided to start the treatments using this band first. Twelve treatments were given with no material change in his refractive findings. I then changed to 6,300 A. U. and gave him nine treatments with this band. Again there was no material change except that his esophoria had increased slightly. At this point another change was made to that band strong around 4,200 A. U. and nine more treatments given with this type of visible radiant energy. At the end of thirty treatments we were just where we started. His visual acuity was 20/100. His subjective acceptance of minus

sphere was still around 0.75 which would not bring vision to normal. His dynamic findings were all out of line with this and treatments with visible radiations were stopped. Two months later the patient's uncorrected distant visual acuity was normal and he was wearing a pair of O. U. + 0.62 D. Sph. ⌒ 2Δ prism base-out, as a temporary correction for near work with comfort.

Case No. 23. Patient: Female, age 8. Patient had an uncorrected visual acuity of 20/22 subjectively. She seemed to accept — 0.50 D. Sph. which seemed to bring her vision to normal. Her static findings indicated a slight amount of myopia while her dynamic findings indicated a slight hyperopic condition. I could place no reliance upon her phoria findings but suspected a pseudo-myopia. Treatments were suggested and started using the 5,500 A. U. spectroband. Twenty-eight treatments being given during a ten week period. I used only the yellow-green band of visible radiation on this patient as there seemed to be some improvement at the end of the twelfth treatment. Her visual acuity at the end of the twenty-eighth treatment was normal. She has used no correction, and as I have said only a band strong around 5,500 A. U. was used. The treatments were given for periods of from seven to ten minutes each with no discomfort on the part of the patient.

Case No. 24. Patient: Female, age 16. Occupation sales work. Patient has used a correction off and on for the past six years. Uncorrected visual acuity 20/80? A pair of — 0.75 D. Sph. gives her 20/24+. Static findings very unreliable, though usually indicating some against motion. Dynamic findings indicate a pseudo-myopia. The phoria findings varied in different refractive periods from 2Δ of exophoria to 5Δ of exophoria at 33 cm. and from 12Δ of esophoria to 5Δ of esophoria at 6 m. I suspected pseudo-myopia and gave the patient five treatments starting with the 5,500 A. U. spectroband. No change in visual acuity occurred during the five treatment periods. Patient failed to return for additional treatments.

Case No. 29. Patient: Boy, age 9. Uncorrected visual acuity 20/80+. He had been given a pair of — 0.75 D. Sph. at the Clinton School free eye clinic last December (1931). These gave him normal vision. He wears them but complains of severe headaches averaging about one a week. Static findings seem to indicate the need of a — 1.25 D. Sph. but dynamic findings indicate a hyperopia of 1.00 D. Corrected he has 1Δ of esophoria at 33 cm. and uncorrected he has 2Δ of exophoria at the same distance. A tentative diagnosis of pseudo-myopia was made and treatments prescribed. He is now being brought in every Saturday by an older brother, five treatments having, when this was written, been given. So far in this case only the spectroband, strong around 5,500 A. U. has been used. This is the only case of pseudo-myopia in which but one treatment each week was attempted, and as but few have been given so far no conclusions can be drawn from the lack of improvement shown by the refractive data taken at the end of the last treatment. As this case is similar to several in which some suc-

cess was secured, it is possible that benefit from the use of visible radiant energy may still be had. The final results of this case will be reported later on.

In analyzing the figures given in Table No. 1, relative to the cases of pseudo-myopia it is well to note first, that in cases numbered 9, 10, 24 and 29 but few treatments were given. In fact in none of these cases were more than nine treatments given and in most of them considerably less. Also, none of these cases show any resultant change in refractive status. In fairness to this ocular experimental work I believe the findings of these four cases should be disregarded and only the results of the treatment work on the other cases, Nos. 3, 16, 18 and 23, studied as a special group. This, then, naturally leaves a far too small a number of cases to have the findings more than indicate certain possibilities for additional study, yet, when viewed from the standpoint of accomplishment it will be noted that in these four cases, three of them, namely, case 3, case 16 and case 23, showed a marked improvement in visual acuity at the close of the treatment period and that the subjective and objective tests also indicated a more natural or normal refractive condition existing.

As far as the use of various bands is concerned it will be noted that in taking into consideration only the four cases in which any large number of treatments were given, that the 6,300 A. U. band was used 33 times with either poor or at least no satisfactory results. The 4,200 A. U. band was used 21 times with either no improvement or very little improvement and the 5,500 A. U. band was used 90 times with either no results or with some degree of success. This would therefore indicate that a further study of the use of these bands of visible radiation, strong around 5,500 A. U., should be made with the results tabulated, as obviously the findings in but four cases cannot be regarded as conclusive. This is particularly true in view of the somewhat similar results obtained by Kurtz[6], who, by using applied psychology, and nothing else, was able to improve vision in several cases of pseudo-myopia.

It will also be noted that in case No. 18 no improvement was made. In this case I had the same measure of co-operation as in the others and subsequently was able to improve uncorrected visual acuity by other optometric procedure.

Just why case No. 18 failed to respond as did the others I cannot say, nor can I explain why in cases 9, 24, and 29 there was no noticeable improvement in the visual acuity early in the course of the treatments before they were stopped. All of these cases were started in exactly the same manner and all of them were cases of the same type of refractive abnormality.

Age of patient seemed to have little to do with the success or failure of the experiment. In case No. 3, which was successful, the patient was 15 years of age. In case No. 16, also successful, the patient was 8. In the No. 18, which was unsuccessful, the patient was

[6]J. I. Kurtz. Ocular Physical Therapy, page 137. 1930.

TABLE NO. 1.

Case number	First Band used	Number of treatments	Results	Second Band used	Number of treatments	Results	Third Band used	Number of treatments	Results	Total number of treatments
3	6300 A. U.	12	poor	5500 A. U.	20	good				32
9	5500 A. U.	6	no change							6
10	4200 A. U.	9	no change							9
16	6300 A. U.	12	no change	4200 A. U.	12	a little improvement	5500 A. U.	30	good	54
18	5500 A. U.	12	no change	6300 A. U.	9	no change	4200 A. U.	9	no change	30
23	5500 A. U.	28	good							28
24	5500 A. U.	5	no change							5
29	5500 A. U.	(Not finished as yet—but no change as far as gone)								5

16 years of age while in a successful case (No. 23) the patient was also but 8 years of age. As optometrists, we have for years considered it advantageous to get these patients as early in life as possible, feeling that any improvement which could be made, was easier to accomplish the younger the patient. However, as all of the subjects of this experiment in this pseudo-myopic group were well within the accepted age range, for the correction of the defect, age, therefore, must be ruled out as a factor in the success or failure of the work.

As to the order in which the bands of visible radiation were placed in use, this, too, seems to have little or no lasting effect upon the patient. In case No. 3 a band strong around 6,300 A. U. was first used without success. This was followed by the seemingly successful use of the 5,500 A. U. band. In case No. 23 only the 5,500 A. U. band was used with equal success. In case No. 16 three bands were used in the following sequence: first the 6,300 A. U. band, next the 4,200 A. U. band and last the 5,500 A. U. band. In this case it was not until the last band was used that any appreciable success was noted. It is because of this fact that I recommend additional study of this work in cases of pseudo-myopia. The meager records herewith presented indicate the possibility of some benefit for these cases by means of color therapy and the matter should be a subject for further study. The writer hopes to be able to continue this portion of his investigation possibly trying additional bands of visible radiation on these pseudo-myopic cases.

Latent Hyperopia.

The second group of cases studied in this investigation were certain selected cases of young people, suffering from hyperopia, in which a fairly large portion of this refractive defect was latent, and in which there was no serious imbalance on the part of the extra-ocular muscles. In other words, the age range decided upon for this group of fourteen cases was from 10 to 24 years. All had some latent hyperopia as shown by the cyclodamic[7] test or by dynamic skiametry and in each of these cases there seemed, from the phoria and duction findings, to be no serious imbalance in the muscles controlling convergence. In the data which follows, the findings of the phoria test and the ductions are omitted as these played but an unimportant part in this study, however, I wish at this time to make it a matter of record that these tests were made, the patients' vision corrected and uncorrected at both 6 meters and at 33 centimeters.

The purpose of this portion of the investigation was to determine if possible just what effect the use of various bands of visible radiant energy would have upon, (1) The total amount of hyperopia, *i. e.*, manifest plus latent, and (2) Whether or not additional plus would be accepted by the patient, without fogging, following the use of spectroband. In other words, whether some of the latent hyperopia

[7]C. C. Koch. Cyclodamic Test. Editorial. Vol. 9, No. 12, American Journal of Optometry. 1932.

could be changed to manifest by the use of visible colored radiations.

Fourteen cases have so far been included in this clinical study, which divided itself into three portions. First a group of five cases, namely, cases Nos. 4, 5, 6, 7 and 8. These first five cases were handled in a manner somewhat similar to the cases of pseudo-myopia previously recorded. A band of visible radiation was first decided upon. The static and dynamic skiametric tests were made, followed by the subjective tests. Next, from 7 minutes to 10 minutes of radiation was given and then the refractive tests made again and the findings recorded. This was done three times each week for a given period of treatments. The spectroband was then changed and the treatments continued. The refractive data of these five cases and the results are as follows:

Case No. 4. Patient: Male, age 16. Occupation student at the Vocational High. Was using the following correction:

O. D. + 0.75 D. Sph. ⊃ + 0.50 D. Cyl. Axis 90
O. S. + 0.75 D. Sph. ⊃ + 0.75 D. Cyl. Axis 90.

History of ocular fatigue. Headaches and inability to do near work with comfort. The refractive findings of interest in this investigation were as follows:

1. Static skiametry =
   O. D. + 1.25 D. Sph. ⊃ + 0.50 D. Cyl. Axis 90
   O. S. + 1.25 D. Sph. ⊃ + 0.75 D. Cyl. Axis 90
2. Dynamic skiametry =
   O. D. + 3.75 D. Sph. ⊃ + 0.50 D. Cyl. Axis 90
   O. S. + 3.75 D. Sph. ⊃ + 0.75 D. Cyl. Axis 90
3. Subjective findings =
   O. D. + 1.50 D. Sph. ⊃ + 0.50 D. Cyl. Axis 90
   O. S. + 1.50 D. Sph. ⊃ + 0.75 D. Cyl. Axis 90

As a start, the subjective findings were prescribed in addition to treatments. A band of visible radiations strong around 6,300 A. U. was chosen to start the work and was used for twelve periods. At the end of this treatment period there was no noticeable change in the refractive findings. To be sure there was a day to day variation of perhaps a quarter of a diopter, one day less and the next day more as is apt to occur in hyperopic cases of any appreciable amount, but the findings at the end of twelve treatment periods were, from the standpoint of any material change, negative. It was noticed, however, that the findings at the close of a treatment period were as a rule a quarter or a half of a diopter weaker than at the start. This difference, however, was not noticeable when the patient returned for his next treatment. The band was then changed to 5,500 A. U. and twelve additional treatments given, again with negative results. His hyperopia, both latent and manifest, seemed fixed and the band was again changed, this time to that type of radiation around 4,200 A. U., eight treatments being given with this band of visible colored, light, again with negative results.

Case 5. Patient: Female, age 11. Occupation, student. Patient had a history of headaches and a general tired feeling after school. No glasses had been used. The initial refractive data was as follows:

1. Static skiametry = O. U. + 0.50 D. Sph.
2. Dynamic skiametry = O. U. + 2.75 D. Sph.
3. Subjectice findings = O. U. + 0.50 D. Sph.

In this case the writer decided not to prescribe a correction at first but to give the patient only treatments so as to more carefully record any refractive changes which might occur. Obviously any correction up to + 1.50 D. Sph. or + 2.00 D. Sph. prescribed for near work in a child of this age would under all probability be shortly accepted for distance and were this originally prescribed it would not enable us to properly evaluate the results of the use of visible radiations in this case of latent hyperopia. As this case was started at almost the same time as Case No. 4 the same order of band application was decided upon. At the end of twelve treatments the findings were the same as at the start. The 6,300 A. U. band was then changed to 5,500 A. U. and four treatments given with this colored radiation. As the patient was now experiencing somewhat more distressing symptoms than at the start of the treatment period it was decided expedient to discontinue treatments at this point. In Case No. 5 sixteen treatments were given, twelve with the 6,300 A. U. band and four with the 5,500 A. U. band. All results were negative. It might be added that the patient is now using O. U. + 1.75 D. Sph. for constant wear with comfort.

Case No. 6. Patient: Male, age 14. Occupation, student. Patient had been corrected with O. U. + 1.25 D. Sph. Referred to writer through the Union City Mission. No particular history except a reluctance to study. A refraction disclosed the following:

1. Static skiametry = O. U. + 1.25 D. Sph.
2. Dynamic skiametry = O. U. + 2.25 D. Sph.
3. Subjective findings = O. U. + 1.25 D. Sph.

Treatments were decided upon, two each week, the writer starting with the 4,200 A. U. band. At the end of eight treatments no change in his hyperopic findings was noticeable and the band was changed to 5,500 A. U. Eight treatments were given with this band of radiation, also with negative results. The third band was then used, *i. e.*, the 6,300 A. U. band, for eight treatments also with no improvement in the amount of plus accepted for distance or with any change in the statically found manifest hyperopia. Treatments were discontinued at this point.

Case No. 7. Patient: Male, age 22. Occupation, bookkeeper. I had prescribed a pair of + 0.75 D. Sph. for this patient four years previously. He now had a history of ocular fatigue after doing his work. A refraction disclosed the following:

1. Static skiametry = + 1.00 D. Sph.
2. Dynamic skiametry = + 1.75 D. Sph.
3. Subjective findings = + 1.25 D. Sph.

His correction was changed to O. U. + 1.25 D. Sph. This gave him comfort at once and after using this for a two-week period he returned for treatments. In this case I again started with 4,200 A. U. band, nine treatments being given with no noticeable results. Patient refused to come longer.

Case No. 8. Patient: Female, age 21. Occupation, office worker. Patient was wearing:

O. D. + 1.25 D. Sph. ⊃ + 0.25 D. Cyl. Axis 45
O. S. + 1.37 D. Sph. ⊃ + 0.25 D. Cyl. Axis 135

This was prescribed by Dr. L., a St. Paul ophthalmologist, using a mydriatic. Patient used this correction for four months and after returning to him on two occasions, came to me, complaining of an inability to do her work. A refraction disclosed the following amount of latent hyperopia:

1. Static skiametry = O. U. + 2.00 D. Sph.
2. Dynamic skiametry = O. U. + 3.00 D. Sph.
3. Subjective findings = O. U. + 2.25 D. Sph. V. A. 20/24+.

This latter correction was prescribed and used with comfort. Two weeks later treatments were started. Patient came in three times each week, during a six week period, ten treatments being given, using the 5,500 A. U. band, this followed by eight treatments, using the 4,200 A. U. band. The results were negative.

Reviewing the work done on these five cases of latent hyperopia we find by referring to Table No. 2 that 99 spectroband treatments were given. In 32 of these treatments the 6,300 A. U. band was used. In 34 of them the 5,500 A. U. band was used, and in 33 of them the 4,200 A. U. band was used. All cases, except No. 7, received a reasonably large total number of treatments, varying from 16 to 32, and in no case was any measure of change recorded in the refractive condition of the eye. This lack of results was naturally somewhat discouraging and for a short period, no more latent hyperopic cases were added to the investigation. Later, however, in reviewing the findings it occurred to the writer that perhaps if a more concentrated use of a single band over a somewhat longer period of time were employed it might add something to our knowledge of this work. Here, also, the number of cases in the study was too small to condemn the use of the therapy for lack of results, so that it was decided to continue the investigation with reference to latent hyperopia.

As it had occurred to the writer that perhaps more than ten or twelve treatments with a single band of visible radiant energy might be necessary to accomplish the sought for change from latent to manifest hyperopia, I, therefore, arranged the second group of latent hyperopic cases for the investigation. These cases are Nos. 13, 14, 17, 19 and 21.

Case No. 13. Patient: Male, age 12. Occupation student. Patient using O. U. + 2.00 D. Sph. History of inability to do near work with comfort. An examination indicated a need for more plus. The findings were:

TABLE NO. 2.

Case Number	First Treatment *Period* Band Used and Number of Treatments	Second Treatment *Period* Band Used and Number of Treatments	Third Treatment *Period* Band Used and Number of Treatments	Total Number of Treatments
4.	6,300 A. U. 12	5,500 A. U. 12	4,200 A. U. 8	32
5.	6,300 A. U. 12	5,500 A. U. 4		16
6.	4,200 A. U. 8	5,500 A. U. 8	6,300 A. U. 8	24
7.	4,200 A. U. 9			9
8.	5,500 A. U. 10	4,200 A. U. 8		18

1. Static skiametry = O. U. + 2.50 D. Sph.
2. Dynamic skiametry = O. U. + 3.25 D. Sph.
3. Subjective findings = O. U. + 2.50 D. Sph.

This case was given 22 treatments with the 6,300 A. U. band, each treatment seven minutes in length. The findings were negative and the treatments discontinued.

Case No. 14. Patient: Male, age 23. Occupation, office worker in newspaper office. History of headaches, frontal and temporal, and also some intra-ocular tenderness. Has never used correction. His refractive findings brought out the following:

1. Static skiametry = O. U. + 0.25 D. Sph.
2. Dynamic skiametry = O. U. + 1.50 D. Sph.
3. Subjective findings = O. U. + 0.37 D. Sph.

Treatments were decided upon and 17 applications of the 5,500 A. U. band given. As there was no improvement in his condition patient refused to have additional treatments and insisted upon being given a correction to make his near-point work easier.

Case No. 17. Patient: Female, age 19. Occupation, sales work. History of using correction about seven years before. No glasses used during the past six years; headaches principal complaint. Refraction indicated a condition of latent hyperopia. The findings were:

1. Static skiametry = O. U. + 0.75 D. Sph.
2. Dynamic skiametry = O. U. + 1.50 D. Sph.
3. Subjective findings = O. U. + 0.37 D. Sph.

This case was given eleven treatments with the 4,200 A. U. band and then discontinued treatments. There was no change in the refractive condition.

Case No. 19. Patient: Male, age 24. Occupation, order checker in wholesale drug house. Patient had a history of ocular fatigue. He came to me using O. U. + 1.00 D. Sph. ⊃ + 1.25 D. Cyl. Axis 180. A refraction disclosed a latent hyperopia. The findings were:

1. Static skiametry = + 1.50 D. Sph. ⊃ + 1.00 D. Cyl. Axis 180 O. U.
2. Dynamic skiametry = + 2.50 D. Sph. ⊃ + 1.00 D. Cyl. Axis 180 O. U.
3. Subjective findings = + 1.50 D. Sph. ⊃ + 1.00 D. Cyl. Axis 180 O. U.

To give him immediate comfort, I at once prescribed the subjective or static finding. This he used for a month and then returned for treatments, 33 being given, using the 5,500 A. U. band. The results were negative as there was no change in the findings of either the static or dynamic tests.

Case No. 21. Patient: Male, age 13. Occupation, student. Patient was last refracted in Omaha where he had been given O. U. + 0.75 D. Sph. This he used with comfort for a year but of late had been experiencing discomfort in his studies. A refraction indicated a considerable amount of latent hyperopia. The findings were:

1. Static skiametry = + 1.00 D. Sph.
2. Dynamic skiametry = + 2.50 D. Sph.
3. Subjective findings = + 1.00 D. Sph.

This case was given 28 treatments, using the 4,200 A. U. band. The results were negative and bifocals were prescribed.

In this second group of latent hyperopic cases, treated for a longer period of time with a single band of visible radiation, there are five cases. Four of these, as indicated in Table No. 3, properly carried out the experiment. In other words, four of these cases were given from 17 to 33 treatments, continuously using the same spectroband. In every case the refractive findings remained unchanged, there being no possibility of adding to the manifest correction. To be sure the group is still too small to enable one to draw definite conclusions from the findings, but it is large enough to indicate that the use of spectroband in seven minute treatment periods, but three times each week, was not at least sufficient to accomplish ciliary relaxation in these latent hyperopic cases. This naturally led to the formation of a third group of these hyperopic cases, the results of which are now being studied.

In this third group of cases will be found Case Nos. 25, 27, 28 and 30. These are cases similar in character to those already presented in hyperopic groups, one and two, but are being treated in a somewhat different manner. I am, in the first place, returning to the use of three bands of radiation, to be used one after the other, until all are

TABLE NO. 3.

Case No.	Radiations Used	Number of Treatments
13	6,300 A. U.	22
14	5,500 A. U.	17
17	4,200 A. U.	11
19	5,500 A. U.	33
21	4,200 A. U.	28

used or until some certain band has produced changes in the refractive status of the case it is being used upon. The change in technique, however, is in the duration of the treatment period, and the number of periods prescribed each week. In this last group of latent hyperopic cases, which I am still working on, I have increased the treatment period from seven minutes to fifteen minutes, and have increased the number of treatment periods from three each week to five or six. To date there seems to be no inconvenience from this increase on the part of the patient. I have been watching this very carefully by frequent ophthalmoscopic examinations, and by frequent charting of the fields. As these experiments are being still carried on, the number of treatment periods being too small to report upon. I am not as yet in a position to report the findings of this portion of the investigation. This material will be presented in a subsequent report.

Esophoria.

The third general group of cases studied in this investigation were certain selected cases of young people showing excessive esophoria accompanied by little or no ametropia. These cases were especially selected so as to be as free from the influence of corrected errors of refraction as possible. Cases of esophoria are by no means rare, yet cases of from 12^{Δ} to 20^{Δ} of esophoria at 6 meters, showing no appreciable amount of refractive error by either subjective, objective or dynamic tests are indeed uncommon, and, when found, frequently present a serious ocular neuro-muscular problem. This problem may be, I believe, a reflex from some other physical abnormality or it may be essentially ocular. In each of the selected recorded cases in this esophoric group, Nos. 1, 2, 11, 20 and 26, the case was first given a physical examination, all with negative results, prior to the ocular treatments.

These physical examinations, let me say, however, were, in my belief, superficial. No effort was made on the part of the examining physician to determine the presence or absence of focal infections by means of the X-ray, in no case was a tuberculin test made, in no case was a metabolism test made and in no case was a Wassermann test made or was blood chemistry made use of. Therefore, we can say that the results of medical examinations of the pulse rate, stethoscopic sounds and possibly a urinalysis was negative. If I may be permitted to digress for a moment, I would like to add that this is one of the great

drawbacks of referring patients to their family physician, a thing necessary, so frequently, in optometric practice. The average general man is too busy to make more than a superficial examination and unless he stumbles on something so outstanding and unusual that he cannot overlook it, he is prone to dismiss the referred case, having no specific or general symptoms, as a normal one, fearing that he might lose the case should he call in specialists who are capable of making a more thorough study of the patient. On the other hand, as optometrists, we cannot, as a rule, refer our patients to the individual specialist for two reasons: First, we frequently do not know to which specialty our patient should be referred, and second, as the case is, at least from the standpoint of original symptoms, ocular, the average specialist in some other field, will, before starting his work, insist upon calling in an ophthalmologist, with the result that the optometrist loses the case. Thus we continue to lean on the family physician with his more simple yet frequently inadequate examination procedure.

However, to return to our third group of cases. As I have said, each of these five cases of esophoria, bordering upon esotropia, were first given some sort of a physical examination prior to being treated by visible radiant energy. Cases Nos. 1 and 2 of this esophoria group which follow were being treated by means of base-in orthoptic treatment techniques when these experiments with visible radiations were started two years ago. In these two cases, the base-in therapy was stopped, despite the fact that in both cases improvement was noted and lamp treatments using portions of the visible spectrum substituted for the use of prisms. Careful observations being made as to the effects of this change. The important refractive data on these two esophoric cases and the other cases in this same group follows.

Case No. 1. Female, age 17. Occupation, student. Her only serious symptom was an occasional near-point diplopia after continued use of her eyes for study. Her subjective and objective refractive findings were negative, she refusing to accept even a 0.25 D. of plus. Her uncorrected visual acuity was normal and her phoria and duction findings were:

1. Phoria at 6 M. = 18$^{\Delta}$ esophoria.
2. Ductions at 6 M. = Add. 22/16. Abd. 3/-2.
3. Phoria at 33 cm. = 14$^{\Delta}$ esophoria.
4. Ductions at 33 cm. = Add. 40/24. Abd. 9/-6.

At the end of eleven base-in orthoptic treatments, using the Hazens Kratometer and the rotary prism, these same findings were:

1. Phoria at 6 M. = 14$^{\Delta}$ esophoria.
2. Ductions at 6 M. = Add. 24/17. Abd. 7/2.
3. Phoria at 33 cm. = 7$^{\Delta}$ esophoria.
4. Ductions at 33 cm. = Add. 44/30. Abd. 15/2.

This was an improvement and as the patient was willing these orthoptic treatments were discontinued and visible radiations substituted, the patient receiving twelve treatments. These treatments were each of seven

minutes duration, using the 4,200 A. U. band. The findings at the end of the twelfth treatment were:

1. Phoria at 6 M. = 10$^{\Delta}$ esophoria.
2. Ductions at 6 M. = Add. 22/15. Abd. 9/4.
3. Phoria at 33 cm. = 5$^{\Delta}$ esophoria.
4. Ductions at 33 cm. = Add. 40/30. Abd. 14/4.

This was a continued improvement. Whether it was due to the use of visible radiations or whether it was the result of the previously given base-in therapy I cannot say. At any rate the symptoms had disappeared, and the refractive findings showed a more normal extra-ocular balance, even though not as yet normal. As patient at this point was extremely anxious to finish the treatments, I then gave her fifteen treatments, combining both the base-in prism therapy and the use of the 4,200 A. U. band. At the end of this time the findings were:

1. Phoria at 6 M. = 7$^{\Delta}$ esophoria.
2. Ductions at 6 M. = Add. 26/18. Abd. 11/6.
3. Phoria at 33 cm. = 1$^{\Delta}$ esophoria.
4. Ductions at 33 cm. = 36/30. Abd. 14/9.

The case was discharged at this point and has had no reoccurrence of the symptoms. She is now working as cashier in a Chinese restaurant and claims to be perfectly comfortable.

Case No. 2. Patient: Female, age 23. Occupation, office worker for seed company. Patient came to me three weeks after, what she termed a nervous breakdown. Her history revealed that for the past six months she had lost weight and about five weeks prior to coming to me she had occasionally suffered from diplopia which became so bad that she had to get a leave of absence from her work. Her family physician put her to bed and kept her there for three weeks. She now felt better but still saw double. There was a slight deviation of the visual axis of the left eye and a noticeable turning in of the left eye under the cover test. She could maintain single binocular vision only with effort, and when tired, not at all. I immediately prescribed base-out prisms for constant wear. 4$^{\Delta}$ for distance and 8$^{\Delta}$ for near point use, instructing her to use her eyes for near work but one-half hour each day. She was not to go back to work until she was stronger. Treatments were to be given daily.

In this case, as in case No. 1, the orthoptic treatment work base-in had been started prior to the beginning of the investigation with visible light, and the lamp was used only at the end of the treatment period. The findings were as follows: Twenty-six base-in orthoptic treatments had been given. Her distance prismatic correction had been discarded, and she was using a pair of O. U. 1$^{\Delta}$ base-out prisms for near point work only. She no longer suffered from diplopia and was again starting work. Treatments were to continue, three each week, until additional improvement was noted. At this point it was decided to use the visible radiations, using the 4,200 A. U. band. Prior to the initial use of this radiation her findings were:

1. Phoria at 6 M. = 10Δ esophoria.
2. Ductions at 6 M. = Add. 22/15. Abd. 10/5.
3. Phoria at 33 cm. = 5Δ esophoria.
4. Ductions at 33 cm. = Add. 26/15. Abd. 11/5.

As in case No. 1 the treatments were for a seven minute period each, and thirteen of these were given with no discomfort. She continued to improve and the base-out near-point correction was discarded. Her findings at the end of the thirty-ninth treatment (26 base-in orthoptic treatments and 13 lamp treatments using the 4,200 A. U. band) were:

1. Phoria at 6 M. = 5Δ esophoria.
2. Ductions at 6 M. = Add. 24/15. Abd. 14/9.
3. Phoria at 33 cm. = 1Δ esophoria.
4. Ductions at 33 cm. = Add. 27/18. Abd. 15/7.

Treatments were discontinued at this point, the patient instructed to return at the end of a month. She did this, and the findings, taken during the post-refraction, indicated that there was no return of the esophoric condition. In August of 1932 I again re-examined this case and found her to be still normal. She was working every day with no discomfort.

Case No. 11. Patient: Female, age 20. Occupation, filing clerk in law office. History of headaches and fatigue in the afternoon. Uncorrected visual acuity normal and no hyperopia. Her phoria and ductions were as follows:

1. Phoria at 6 M. = 28Δ esophoria.
2. Ductions at 6 M. = Add. 30/16. Abd. 5/0.
3. Phoria at 33 cm. = 18Δ esophoria.
4. Ductions at 33 cm. = Add. 28/18. Abd. 7/-1.

I suggested treatments, when she returned from a two weeks vacation, and at the end of her vacation her findings were:

1. Phoria at 6 M. = 21Δ esophoria.
2. Ductions at 6 M. = Add. 28/17. Abd. 6/2.
3. Phoria at 33 cm. = 13Δ esophoria.
4. Ductions at 33 cm. = Add. 28/18. Abd. 6/3.

Because of the possible success with the 4,200 A. U. band in the two similar cases of this type previously treated (cases Nos. 1 and 2), I decided to start with this band of visible radiation. Treatments to be given three times each week for a period of at least three months. At the end of nine treatments the patient refused to come in for further treatment. Her findings were:

1. Phoria at 6 M. = 18Δ esophoria.
2. Ductions at 6 M. = Add. 34/18. Abd. 7/4.
3. Phoria at 33 cm. = 10Δ esophoria.
4. Ductions at 33 cm. = Add. 30/22. Abd. 9/5.

While these findings indicate a small amount of improvement, the case was still far from being normal, though the patient felt that she was very much improved.

Case No. 20. Patient: Female, age 22. Occupation, assistant in library. History of occasional headaches. No refractive error. Her findings were:

1. Phoria at 6 M. = 15$^{\Delta}$ esophoria.
2. Ductions at 6 M. = Add. 36/20. Abd. 4/0.
3. Phoria at 33 cm. = 12$^{\Delta}$ esophoria.
4. Ductions at 33 cm. = Add. 44/18. Abd. 5/0.

Treatments using visible radiations were decided upon, the writer deciding to use the 5,500 A. U. band first. At the end of twelve treatments the findings were but little improved, and the band was changed to 4,200 A. U., eleven treatments being given with this band of visible radiation. The findings at the end of the twenty-third treatment were:

1. Phoria at 6 M. = 14$^{\Delta}$ esophoria.
2. Ductions at 6 M. = Add. 40/26. Abd. 7/3.
3. Phoria at 33 cm. = 11$^{\Delta}$ esophoria.
4. Ductions at 33 cm. = Add. 46/26. Abd. 9/3.

While the patient felt that something had been accomplished, I, nevertheless, was not satisfied with the results and prescribed ten base-in orthoptic prismatic treatments which brought the abduction at 33 cm. up to 15$^{\Delta}$ break, and 7$^{\Delta}$ recovery. The case was then dismissed.

Case No. 26. Patient: Female, age 19. At present unemployed. History of some headaches. This patient has but little hyperopia and 19$^{\Delta}$ of esophoria. I am now giving her treatments, using various spectroband. Results will be reported later as patient can come to the office but one or two times each week.

To review the findings in the four completed cases of esophoria we find that each case showed some change. In the first two cases, to be sure, the usual optometric techniques had been prescribed, prior to the use of the spectroband, but it is interesting to note that some improvement was made after these orthoptic treatments had been discontinued and the visible radiations used in their place. It is also interesting to note that in case No. 11 and No. 20 that there was a small reduction in the amount of esophoria without the use of prismatic orthoptic treatment. To be sure, a far too small number of cases were treated to enable one to form any satisfactory conclusions other than that already expressed, *i. e.*, "That additional study and investigation be given to the matter."

It is also interesting to note that as the patient's health improved (Case No. 2) or as the patient rests and relaxes (Case No. 11), the amount of esophoria decreases. In these cases just reviewed it is impossible to ignore these factors and also the psychological effect of doing something for the patient. Nevertheless, in each of the four cases reported, some measure of change was recorded, thus certainly indicating the need for additional study of the effects of visible radiations on these cases of esophoria.

Excessively Large Amounts of Hyperopia.

The fourth group of cases studied in this investigation were certain selected cases of young hyperopes in which nearly all of this refractive defect was manifest, and which in each case, a large amount of the error existed. This as yet uncompleted investigation was made to disclose: First, just what effect the use of various spectrobands would have upon the manifest hyperopia itself as evidenced by the subjective findings; second, the effect of the use of visible radiations upon the static and dynamic findings in cases where there was a large amount of correctible error present; and third, the effect of these radiations upon the patient's corrected and uncorrected visual acuity. The reason for selecting cases of large amounts of error was that in an investigation of this sort, where refractive findings are taken from day to day, that normally slight changes occur in the findings in cases of lower error, whereas, in cases of high error, the day to day refractive findings are more apt to remain constant unless the treatments or some other element is in some way a disturbing factor. All refractionists know of the almost daily quarter diopter changes which occur in many cases of hyperopia of a diopter or two, yet in those cases where the manifest correction is around six or seven diopters, these small changes are, as a rule, absent, the patient accepting the correction and being almost instantly aware of any variation, irrespective of how small. It was for this reason that these cases were chosen, the writer regretting that only three patients, so far, have consented to assist in the ocular investigation with bands of visible radiation in this group. A report of these three cases follows:

Case No. 12. Patient: Male, age 14. Occupation, student. He has been using a plus correction for eight years. Now having perfect comfort with the following correction:

O. D. + 7.50 D. Sph. ⊂ + 1.75 D. Cyl. Axis 90
O. S. + 7.50 D. Sph. ⊂ + 1.25 D. Cyl. Axis 90

His corrected visual acuity was 20/24. Although there was no history of discomfort, treatments were arranged, the findings at the start being:

1. Manifest hyperopia (subjective):
   O. D. + 7.50 D. Sph. ⊂ + 1.75 D. Cyl. Axis 90
   O. S. + 7.50 D. Sph. ⊂ + 1.25 D. Cyl. Axis 90
2. Static skiametry:
   O. D. + 7.00 D. Sph. ⊂ + 1.75 D. Cyl. Axis 90
   O. S. + 7.00 D. Sph. ⊂ + 1.25 D. Cyl. Axis 90
3. Dynamic skiametry:
   O. D. + 8.50 D. Sph. ⊂ + 1.75 D. Cyl. Axis 90
   O. S. + 8.50 D. Sph. ⊂ + 1.25 D. Cyl. Axis 90
4. Corrected visual acuity, O. U. 20/24.
5. Uncorrected visual acuity, O. U. 10/300.

Here is a case of hyperopia with some astigmatism. There was no involvement of the extra-ocular muscles. From a purely physiological

aspect, nothing could be done for a case of this kind, except to correct the ametropia with lenses. The treatments were given, not in the hope of changing the amount of hyperopia, but rather to see just what effect various bands of radiations would have upon his correctible refractive error. The first band used was the 6,300 A. U. radiation. This was used for six treatment periods. There was no appreciable change in the findings which were taken before and after each treatment. The treatments were each given for a seven minute period. The band was then changed to 4,200 A. U. and this used for six treatment periods. Again there was no change in the findings, but the patient reported a slight headache following several of the treatment periods. This is the only case reporting any discomfort from the use of visible radiations. The band was then changed to that one strong around 5,500 A. U. Here was found the only change which occurred in any of these treatments on this patient. After each treatment period the findings were from one-half to three-quarters of a diopter weaker than before the treatment. Yet, 48 hours later the findings were back at the original starting point. After each treatment his corrected visual acuity was 20/24?? with his glasses, but was 20/24 with a correction in the trial frame a half a diopter weaker than the usual correction. As indicated, his glasses would blur his vision for several hours following the treatment. As most of these treatments were given after school, he expressed himself that his eyes seemed to blur until after dinner, then it would pass away and everything would be normal until the next treatment. There was no permanent change resulting from the nine treatments given with the 5,500 A. U. band and six months after the treatments were discontinued he again showed no change, I having the opportunity to re-examine him at this time.

To briefly summarize the results in this case, six applications of the 4,200 A. U. band showed no change, six applications of the 6,300 A. U. band showed no change and then nine applications of the 5,500 A. U. band also showed no permanent change but did show a slight day to day decrease of the hyperopia immediately following the application of the visible radiations. Just what caused this change I am not able to say. That the change occurred, I am positive, the temporary change in both visual acuity and in the amount of plus accepted being the same or nearly so each time the 5,500 A. U. band was used.

Case No. 15. Patient: Girl, age 13. Occupation, student. History of strabismus at the age of five. Using correction since that time. Came to me for a new correction as she had outgrown the old one. No discomfort. Was using O. U. + 6.00 D. Sph. An examination disclosed no particular involvement of the extrinsics and that a pair of + 6.50 D. Sph. would give the best obtainable visual acuity, namely, 20/24. Treatments were suggested, the same findings as recorded in case No. 12 being recorded at the start and close of each treatment period. Because of the unusual results obtained with the

5,500 A. U. band in the preceding case in this group, it was decided to start the treatments, using this band of visible radiation. This was done for eight treatments with no appreciable change in the findings or in the acuity of vision. As it was quite inconvenient for the patient to come in for treatments, these were discontinued at this point. The findings on the use of the 5,500 A. U. band in this hyperopic case being negative.

Case No. 22. Patient: Boy, age 14. Occupation, student. History of using a correction for the past seven years. A refraction disclosed the need for the following formula:

O. D. + 7.00 D. Sph. ⊃ + 1.00 D. Cyl. Axis 105
O. S. + 7.00 D. Sph.

This he used for 20 days. At the end of this period he came in and reported comfort. A post-refraction was made, the findings of which agreed with his correction. Treatments were started, first using the 4,200 A. U. band. Nine of these treatments were given, the results being negative. The band was changed to 5,500 A. U., six treatments being given, with also no appreciable change in the day to day refractive findings. The band was then changed to 6,300 A. U. and six treatments were given. Here again there was no change. Also there was no discomfort. All the treatments were given for a seven minute period. At the end of the fifteenth treatment the case was dismissed.

In this small group of cases of hyperopia the results were not encouraging. To be sure, in case No. 12 something did seem to affect the ciliary action when the 5,500 A. U. band was used, but I have failed to get the similar response when the same band was used in other hyperopic cases of large amounts. In cases Nos. 15 and 22 no response was noted. Here, too, as in the latent hyperopic group of cases treated during this investigation, the technique of applying the radiations might be at fault. Either the wrong band was used or the distance between the lamp and patient was too great or the treatment period was too short. Only further investigation will throw light upon these questions.

Summary.

In reviewing the results of the investigation to date on thirty optometric cases of either refractive abnormality or ocular neuromuscular defect it is well to first note that of the thirty cases included in this report (see Table No. 4), six cases, Nos. 5, 7, 9, 10, 17 and 24, received too few treatments to enable the writer to draw any conclusions from their findings, and six cases, Nos. 25, 26, 27, 28, 29 and 30, are still being worked upon. Of the remaining eighteen cases, ten cases, Nos. 4, 6, 8, 13, 14, 15, 18, 19, 21 and 22, showed no effect from the use of visible radiations, while eight cases, Nos. 1, 2, 3, 11, 12, 16, 20 and 23, showed, in some way, a change which might or might not be attributed to the use of the lamp.

Of the eight cases showing change, four of these were cases of

high degree of esophoria unaccompanied by any appreciable amount of ametropia, three of these were cases of pseudo-myopia, and in one case of hyperopia of large amount there seemed to be some temporary physiological change or reaction from the treatments.

TABLE NO. 4.

Case No.	Refractive Condition	Number of Treatments	Results
1	Esophoria	38[1]	Good
2	Esophoria	39[2]	Good
3	Pseudo-Myopia	32	Good
4	Hyperopia	32	No change
5	Hyperopia	16	No change[3]
6	Hyperopia	24	No change
7	Hyperopia	9	No change[3]
8	Hyperopia	18	No change
9	Pseudo-Myopia	6	No change[3]
10	Pseudo-Myopia	9	No change[3]
11	Esophoria	9	Improvement[3]
12	Hyperopia*	21	Slight change
13	Hyperopia	22	No change
14	Hyperopia	17	No change
15	Hyperopia*	8	No change
16	Pseudo-Myopia	54	Good
17	Hyperopia	11	No change[3]
18	Pseudo-Myopia	30	No change
19	Hyperopia	33	No change
20	Esophoria	33	Improvement
21	Hyperopia	28	No change
22	Hyperopia*	21	No change
23	Pseudo-Myopia	28	Good
24	Pseudo-Myopia	5	No change[3]
25	Hyperopia		Unfinished
26	Esophoria		Unfinished
27	Hyperopia		Unfinished
28	Hyperopia		Unfinished
29	Pseudo-Myopia		Unfinished
30	Hyperopia		Unfinished

*True hyperopia, not latent as were all of the other hyperopic cases mentioned in the above investigation. This separate group of three cases, Numbers 12, 15 and 22, were studied to ascertain the action of visible radiant energy on large amounts of hyperopia.

[1]Eleven of these treatments were base-in orthoptic treatments, 12 of them were lamp treatments and 15 treatments combined the base-in prism therapy with the use of the lamp.

[2]Twenty-six of these treatments were base-in orthoptic treatments, 13 of them were lamp treatments.

[3]Findings incomplete because treatments were discontinued.

Of the group of cases in this investigation, those of latent hyperopia seemed to show the least change, from the use of visible radiation. Whether this was due to a defective technique in applying the radiation, or whether visible radiations are incapable of producing ciliary relaxation, I do not as yet know. However, we have at least so far failed to accomplish this.

As pointed out at the beginning of this report, a private practice has its limitations in doing clinical research work of this character. The amount of experimental material is somewhat limited and this makes the work necessarily slow. It is interesting work, however, and must be done carefully and without haste, one feeling one's way along from point to point, making the changes necessary from month to month as one thing fails, or another succeeds.

The number of finished cases presented in this report is, as I have said before, too small to enable an investigator to draw any definite conclusions from the use of visible radiations, in cases of ocular-refractive and muscular abnormalities. The findings of this investigation do, I believe, warrant my suggesting that they be continued to a greater degree, preferably with a lamp with a known and controlled amount of illumination, and I am hopeful that others will be added to the role of clinical research workers in this, as yet, greatly unexplored field. A year from now I hope to be able to add to this report and hope to be able to present a larger number of successful suggestions as to the use of specific portions of the visible spectrum in ocular practice.

DR. CAREL C. KOCH,
1501-1504 FOSHAY TOWER,
MINNEAPOLIS, MINN.

ABSTRACT OF DISCUSSION

DR. H. RILEY SPITLER, EATON, OHIO: I have enjoyed the presentation of Dr. Koch's investigation of the use of light frequencies in the visible range of cases of hyperopia, pseudo-myopia and esophoria.

My experiences in cases of hyperopia and myopia are in full agreement with the results of Dr. Koch's investigation, particularly with reference to the wave lengths Dr. Koch has said he used. I do not believe it is possible by the use of any selected wave lengths in the visible range to materially alter purely anatomical changes in structure in the eye or its appendages. Obviously, to expect such results is just as impossible as to expect a diminutive leg to increase in length to that of its normal fellow by the use of light in the visible spectrum.

In the case of pseudo-myopia, at least one of the wave length bands mentioned by Dr. Koch should be of some value. Here the matter of technique enters quite materially into the consideration of whatever results are to be obtained. In the first place the duration of the irradiation was entirely too short to accomplish results in pseudo-

myopia that can in any way compare with those obtainable by another technique which will be discussed later on this program.

Furthermore, the subject of intensity of illumination is another factor which I am sure contributed to the low ratio of changes in his classifications if my experience is a criterion by which to judge.

With reference to esophoria, your discussant believes that he is unqualified to evaluate the report by Dr. Koch because data that your discussant ordinarily would take into consideration before prescribing selected light frequencies to a case of esophoria or exophoria have not been presented in Dr. Koch's paper. The discussant, therefore, is unable to evaluate Dr. Koch's experiences with these two conditions in terms of the discussant's experiences and those of his associates who have been investigating this problem. It might be said, however, that our results are at variance with those reported by Dr. Koch in these two conditions, and in the absence of further data contributed by Dr. Koch more can not be said at this time.

Perhaps in your discussant's presentation to be given later during these sessions he will clarify some of the points and factors hinted at above as necessary to a more lucid discussion of Dr. Koch's paper.

OPTOMETRY'S OBLIGATION IN THE RECOGNITION OF OCULAR DISEASE*

D. R. Paine, Opt. D., F. A. A. O.
Topeka, Kansas

The intent of this paper is to discuss optometry's "diagnostic responsibilities" with a brief reference to some of the most common eye pathologies and some of their cardinal symptoms.

Selection of this timely subject is inspired as a result of the impartial verdict, relative to optometry's educational weakness, rendered by that just tribunal, the Committee on the Costs of Medical Care.

This appeal, that optometry owes society a more adequate obligation than is being assumed by the profession as a whole, in the recognition of disease, both local and general, as related to eye symptoms, is humbly presented to this auspicious assembly because, in keeping with traditions of the high educational standards of American Academies to foster and promote advancement, it is the office of our society to encourage, through precept, both graduates and under-graduates to vigorously fortify, educationally, against this obvious and dangerous weakness.

It seems a fitting introduction to the discussion of this subject to quote two paragraphs from the report of the Committee on the Costs of Medical Care, which are pertinent to the theme:

> "It is obvious that optometrists now perform a needed service, nevertheless there are certain valid objections to the present place of these practitioners in medical care."

"The body," as one physician has said, "is a whole, one and indivisible, in pathology and for purposes of diagnosis. It can best be cared for by those who understand this and have been broadly trained in all that pertains to the body and its health, so that however they may specialize they have a good understanding of the limits of their specialty and can intelligently advise as to what direction relief from any particular symptom or group of symptoms should be sought."

It is further stated that "Most ophthalmologists admit that the training which optometrists now receive amply qualifies them for a de-

*An abridgement of the material presented before the American Academy of Optometry at Chicago, December 19, 1932.

termination of the refractive error and its correction by glasses." "Difficulty arises, however, in the cases of local or general pathology. Lacking a general medical training, optometrists may fail to detect the true nature of the ailments of these patients. Failure to recognize these pathological or abnormal conditions will involve the prescription of glasses unnecessarily and much more important, the neglect of conditions requiring attention."

Why should the optometrist familiarize himself with ocular symptoms of pathology?

(1) Because patients ignorant of the fact that eyes are disturbed as a result of local or general pathology, frequently consult the optometrist first.

(2) Because pathology is frequently the underlying cause of many of the visual inefficiencies which optometrists are called upon to treat.

(3) Because there are many pathological conditions of which the diagnostic factors belong in the optometrist's proper field of procedure—binocular imbalances, squints, visual defects, field charts and what not.

These signs with their pathological significance should be understood to the end that the patients' welfare is safeguarded and that the optometrist avoids failure and sustains and strengthens his reputation by co-operation with selected medical or dental authorities.

We must not, like the ostrich, conceal our heads and remain oblivious to the dangers about us. We must meet the charges constructively. It is evident to us all that our profession, en masse, is circumscribed within narrow educational limits and that our professional status will not advance to that higher plane enjoyed by dentistry and others of the healing arts until the shackles of ignorance are broken. It is generally agreed, among educationally minded leaders that we would do well to follow the successful fundamental educational precedents established by the more advanced professions.

The mill of evolution, like the mills of the Gods, is grinding slowly but surely very apparent educational reforms within our profession. Our optometric educational institutions have made meteoric advancements despite the fact that the progressive ones recognize that there is much yet to be done in the march of progress. The veterans in practice are being awakened from their lethargy into a consciousness of educational necessity and professional responsibility. There is a marked tendency of public opinion to grow professional minded in matters pertaining to the care of their eyes—all of which gives promise that when our inherent and obvious educational weakness is remedied, we can attain, in the not distant future, an educational structure and a professional recognition equal in scope and dignity to that of dentistry.

Our graduates are becoming progressively better equipped to recognize local eye pathology. They will improve in the understanding and will acquire the ability to recognize general pathology as related to eye

symptoms, no sooner than the academic facilities are extended to embrace a decidedly broader knowledge of the fundamental medical sciences. This curriculum of course to be complemented by a finished clinical experience. Eye symptoms of systemic disturbances is a sadly neglected phase of optometric education. Both local and general pathology as related to eye symptoms, is but little understood by the rank and file of those in optometric practice.

It would be economically unsound for optometry to devote the seven to eight years of academic education now required by medicine just as it is "uneconomic" for ophthalmology, with this extensive educational investment, to practice optometric pursuits. It follows that eventually optometry will be delegated to the exclusive responsibility of non-medical eye care when medicine and the public recognizes that optomtry is educationally prepared.

In some of the larger clinics, the division of labor principal is employed whereby patients who have been inspected first for ocular or systemic diseases are finally submitted to optometrists for non-medical eye service just as dentists are called upon for their "division of labor." Under this regime, optometrists would not need the extensive academic preparation embodying the basic medical sciences. But it is obvious that under this proposed panel system that much of their incentive for broader academic education would be stifled. When the competition of individuals in practice is removed and men placed on a payroll under community health plan or in institutional practice, much of the initiative is destroyed and it has been found by staff doctors in some places where such systems have been used, that the plan often leads to shoddy methods and less careful attention to patients.

In every community and with every profession there are the "ne'er do wells" who find it difficult to make a living and this type will support such a plan so as to receive employment. Then there is the successful class to whom gravitate most of the practice who are opposed to the loss of identity and the decrease in income which such a change would entail. Nevertheless the community would still wish the successful group to render most of the service and we must not lose sight of the fact that our interest in our service is to no small extent commensurate with the returns derived therefrom. Under the community or state medical systems it is claimed that they have little better than "machine made remedies and treatment." I have treated this particular topic at some length because of its widespread agitation at this time.

Since it is improbable that optometry will bury itself within the stifling confines of institutional walls, it is imperative that the individuals embodied in our entire profession recognize and correct the educational shortcomings discussed herewith or continue to be a subordinate among professions operating under the stigma of "mechanical eye-quacks."

Naturally, general advancement of our profession would be slow if this proposed educational movement were confined exclusively to the undergraduates. The large group now in practice is more sorely in need of educational regeneration.

Post-graduate facilities if established by all of our optometric colleges would assist in this movement. The study groups, which are so firmly established throughout the nation could be provided with the needed material and guided as to its effective use as part of this research group activity; the optometric press could publicize and help in this concerted movement; there are progressive ophthalmologists and talented optometrists in every community of any size who could be conscripted to aid in this renaissance.

Incidentally, it seems that because of the present lack of suitable coordinated post-graduate facilities and until better methods are provided that the responsible itinerant educators should receive encouragement instead of discouragement. Such support should be the reward for the good that they have accomplished and can further accomplish in important educational organization work. This work has resulted in educational mindedness among the rank and file of optometrists throughout the length and breadth of the land, many of whom would never have gone elsewhere in search of knowledge. It would seem advisable before granting endorsement, to have such itinerant instruction subject to strict regulation under supervisory control of an impartial board established for that purpose, or as has been suggested: "These educators should come as an extension course from accredited colleges."

There are factions who would reshape our laws to do three things which would bring us into violent conflict with the medical fraternity with all of the logic on the side of the medics:

(1) Remove the prohibition against the use of drugs.

(2) To force the eye-physician to qualify before the optometry board.

(3) To legalize "differential diagnosis."

Shall we try the complete hurdle all at once and skin our noses and knees? Shall we assume powers which we are unprepared to wield? Shall we pass up the fundamentals which are the life blood of our service, half learned, misapplied as the saying goes "with just enough of learning to misquote" because of our unbridled avarice for powers which ignorantly used could destroy us? We have too many new and unimproved claims to which we give attention and too little knowledge of existing facts. The sooner our profession masters those fundamentals which are the foundation of our professional structure the quicker we will be prepared for the expansion of these powers.

Prompted by the belief that ocular pathology should be one of the early subjects for consideration in the proposed plan for the graduate group, a discussion of that subject is herewith presented. Instruction for optometrists relative to systemic disease as related to eye symptoms should be conducted by ophthalmologists who not only have the basic training but extensive experience in practice. Space will not permit more than a mere reference to the most common eye diseases and their cardinal symptoms. The presentation is much in the nature of a suggested outline of study.

The sustaining processes of life are circulation within the body and innervation of its cells. Whenever the autonomic nervous system is disturbed it affects circulation and the normal flow of nerve energy. Should the eyes be the source to register the complaint, there may be one or a number of complex ocular stress symptoms such as headaches, ocular pains or fatigue, dizziness, impaired accommodation or disturbed muscular coordination of the globes.

Whether or not the disturbance is entirely a local problem due to eye disease or inefficient vision or a reflex from the general system resulting from disturbed metabolism, is a question the answer to which places the stamp of ability or inability on the operator.

Since the eye is so peculiarly open to inspection we can all acquire the simple technique of carefully observing it. This can be done with understanding as soon as we can differentiate between a healthy and an unhealthy status. We must learn to understand eye pain and distinguish the various retinal inflammatory processes differentiating them from optic atrophy. We must learn to avoid confusing the symptoms of iritis with glaucoma, lens clouding with vitreous opacities and learn to detect the more common external eye diseases.

In regard to eye diseases in general it may be said that those which attack the front parts of the eye (conjunctiva, cornea and sclera) are usually acute infections. Those that attack the middle coats of the eye (iris and ciliary body) are usually sub-acute, secondary infections resulting from systemic or focal conditions. Those that affect the back part of the eye (retina, choroid and optic nerve) are usually chronic degenerations.

For convenience we will discuss the diseases common to those parts of the eye in the order named above

(I) Front parts (conjunctiva, cornea and sclera):

1. *Conjunctiva:*

   If this vascular membrane which contains many lymph glands is diseased, it bathes the cornea with a thick sebacious material which often obstructs vision. It is subject to bacterial infections and inflammations such as catarrhal conjunctivitis and tuberculosis.

2. *Cornea:*

   Clinical observation should embrace the following:

   (a) *Surface:* Whether curvature is even and polished like a mirror reflecting symmetrical images or dull as in glaucoma, or irregular as in panus or interstitial keratitis.

   (b) *Ulcers:* This causes distortion of objects and change in index of refraction.

   (c) *Opacities* resulting from former ulcers or injuries.

   (d) *Panus*, formation of a foreign membrane due to roughened conjunctiva.

(e) *Staphyloma,* the final outgrowth of ulcer with perforations.

Those conditions which produce opacities of the cornea are:

(a) Keratitis.
(b) Ectropian and entropian.
(c) Trachoma.

3. *Sclera:*

Principal diseases of this coat are:

(a) *Episcleritis:* Superficial inflammation.
(b) *Scleritis:* Inflammation of its deeper layers.

(II) Middle Coats (iris or ciliary):

The most common affections are:

(a) Iritis.
(b) Cyclitis.
(c) Spasm of accommodation.
(d) Glaucoma.
(e) Injuries, myosis, mydriasis.
(f) Occluded pupilae.
(g) Third nerve paralysis.

Since the uveal tract, constituting iris, ciliary body and choroid, is the nutritive coat, its health status is of vital importance to the nourishment of the non-vascular transparent tissues: vitreous, crystalline lens and aqueous. Uveitis always points to focal infection or intoxication. Uveitis may also influence the nerve supply, seriously interfering with motility and accommodation of the eyes. Eye strain is very often due to a very slight and insidious uveitis. Inflammation of these coats render the humors cloudy.

Because of the importance of recognizing some of the cardinal symptoms which manifest within the uveal tract, it might be well to point out the following differential diagnosis:

Between iritis and glaucoma—in iritis the pupil is small, while in glaucoma it is usually dilated. In iritis the patient is usually under the ages of 45 to 50, while in glaucoma the victim is usually at or beyond the middle time of life. The anterior chamber is usually more shallow in glaucoma than in iritis. In glaucoma the cornea is usually more insensitive to touch while in iritis the cornea is hypersensitive.

Because of the prevalence of glaucoma and the seriousness of failing to discover early its presence, it seems fitting to elaborate at this juncture, with the following additional comments:

Suspect glaucoma when accommodation amplitude is much reduced and when iris bulges forward.

The sharp bend of a single vessel immediately at the disk edge is sufficient evidence in every case for the diagnosis of glaucoma. The very moment a cup becomes marginal at a single place it is glaucoma. Large physiological cup bears watching.

With glaucoma there is a pronounced alteration in the peripheral field of vision before the central field is affected. There will be a pro-

portionate constriction of both form and color fields as the disease advances. It has been stated that "the earliest changes in the fields of vision is in the region of the blind spot and that a normal blind spot therefore excludes glaucoma."

Serious mistakes resulting in neglect, with dire consequences, have occurred when glaucoma has been mistaken for cataract and the eyes were allowed to wait, without attention, for the ripening of a cataract which never existed.

The prognoses that all forms of glaucoma result in blindness if unchecked by proper treatment should ring warning in our ears.

In differentiating between iritis and conjunctivitis it is best to give attention to the following points:

Conjunctivitis presents a discharge.

Uncomplicated iritis does not.

In conjunctivitis the greatest redness is situated posterior to the cornea while in iritis the greatest amount of redness is around the sclero-corneal margin.

In conjunctivitis the injected blood vessels are on the surface and are movable by lid pressure while in iritis the inflammation is deep seated and not so affected by pressure.

The pupil reaction to light is sluggish in iritis but the reflex is normal in conjunctivitis. Barring complications the vision is undisturbed in conjunctivitis but is perceptibly dimmed in iritis due to turbidity of the aqueous or from exudates on the lens. The luster of iris which is impaired in iritis is unimpaired in uncomplicated conjunctivitis.

(III) Posterior part of the eye (retina and optic nerve. Choroid has been touched upon in connection with uveal tract:

1. *Retina.* Any affection of the retina or macula will reduce vision. Sometimes the disease is not sufficiently developed to be detected with the ophthalmoscope but can be discovered by field study.

   Some of the disturbing retinal vascular diseases are:

   (a) Anemia
   (b) Hemorrhages
   (c) Hyperemia
   (d) Arteriosclerosis
   (e) Embolism
   (f) Thrombosis
   (g) Pigmentary Degeneration
   (h) Detachment

   Diffused clouding of retinal details, especially around the disk, indicates neuroretinitis. Star shaped spots around the macula with small flame-shaped hemorrhages usually indicate albuminuric retinitis.

2. *Optic Nerve.*

Principal diseases are:

(a) Hyperemia
(b) Atrophy
(c) Inflammation

Hyperemia and inflammations are easily seen at the disk. Atrophy, however, may be very slow and insidious, starting from the brain and manifesting itself in the disk at a later stage. The rapidity of failure of vision depends upon the area of the nerve which is first affected. Toxic amblyopia, usually a degeneration of certain parts of the optic nerve or retina, are unknown in childhood and rare among young men and women. Tobacco, alcohol, syphilis and certain drugs are the most common agents productive of this affliction.

In general, retinal diseases as differentiated from simple optic atrophy as revealed by the ophthalmoscope are characterized as follows: retinal diseases are commonly accompanied by swollen tortuous vessels, by a diffused haziness of vessels and clouded disk and by the presence of exudates, pigmentation or various lesions leading to degeneration of the organ while with simple optic atrophy, the disk is sharp, regular, normal in size and very distinct and presents a grayish blue appearance; the surrounding retina is usually unaltered, the retinal vessels are normal except in chronic cases where the vessels diminish in size and degenerate.

In concluding, it might be well to state that while it would be extremely satisfying for optometrists to be able to deftly discriminate between all of the multitudinous retinal pathologies, classifying and differentiating between those fundus conditions caused by renal ills, syphilis, tuberculosis and others of the systemic disturbances which register in the eyes, it is not at all necessary for optometrists to devote the many years of study and observation required to become expert at fundus diagnosis.

It has been most illuminating in contacting some outstanding ophthalmologists to find that the more advanced they are the quicker they admit the fallacy of attempting to diagnose, independently, all of the retinal disease processes without the collaboration with laboratory specialists. It is only the most glaring and obvious foveal pathologies which make diagnosis safe independent of auxiliary health analysis.

In the humble effort put forth in this paper, if I have been successful in tuning in to a sympathetic accord as to optometry's most urgent educational apathy and have added some further impetus to that aspiration which I know exists within each of you to lend influence toward correcting this obvious ill, the paper will have fulfilled its mission.

DR. D. R. PAINE,
NATIONAL RESERVE BLDG.,
TOPEKA, KANSAS

A CASE OF SUBNORMAL VISION—GLAUCOMA*

H. Leslie Salov, Opt.D.
Newark, N. J.

Patient: Mr. A. L. H., age 74, seen in October, 1932. Was examined six years ago by an ophthalmologist and was told he had glaucoma in both eyes. He was treated for this condition for two years without any apparent help. He then went to see another ophthalmologist, who told him he could not improve his vision. The patient complained that for the last fifteen years he had not been able to read even the largest headlines in the newspapers. He felt that he could manage sufficiently well to go about in the street by himself, but he wanted to read, if it was at all possible.

Externals: N. V. A. R. E. Light perception. L. E. 10/200.

Ophthalmoscope: R. E. Cornea lens and vitreous clear. Glaucomatic cup with atrophic changes. L. E. Similar picture.

Fields: R. E. Form fields blind with the exception of an area of about 10 degrees temporally. L. E. Form fields: Superior 40 degrees, inferior 43 degrees, nasal 42 degrees, temporal 72 degrees.

Refraction: R. E. plus 2.00. L. E. —2.50 Cyl. axis 90 degrees. R. E. with telescopic unit, —2.50 Cyl. axis 90. With telescopic spectacles with a magnification of 2.2 times: —2.50 Cyl. axis 90 degrees, visual acuity 8/20, reads to 5F. with plus 6 add.

Remarks: For the last two months, the patient has been reading the smallest type in the newspaper comfortably. He now goes to the movies and enjoys the picture to the extent of observing the mode of dress and the facial expressions of the actors on the screen.

DR. H. LESLIE SALOV,
28 JAMES STREET,
NEWARK, N. J.

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EDITORS

DR. CAREL C. KOCH
1501 Foshay Tower
821 Marquette Avenue
Minneapolis, Minn.

DR. JACK I. KURTZ
1501 Foshay Tower
821 Marquette Avenue
Minneapolis, Minn.

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OPTOMETRY'S ADVANCEMENT

During the present period many evolutionary and revolutionary changes are taking place the world over in the economic, political and social structure of society. All strata of society are affected by these changes, professions included. Optometry, like all other professions, feels the need of certain changes to keep abreast with the changing times. There are a few optometrists here and there who are brave and courageous, who dare stand up and propose certain changes in the practice of optometry so as to make the profession more complete and more useful to the public. These men have a vision and courage to back up their convictions in spite of the fact that as a minority they meet the disfavor of the politicians and more conservative elements of the profession. For this group of thinkers and workers for optometry's advancement, we not only have the highest regard but also a word of encouragement, *carry on your work by all means*, and success will be yours in the end. If we turn a page in the history of other professions we find similar conditions existed in the not distant past. For instance, if we look at medicine we find that some of the men who had visions and ideas about medical advancement were not only opposed but ridiculed as well. No one today (for instance) would question the propriety of a medical college operat-

ing a hospital for demonstration purposes and research, yet less than one hundred years ago when Professor Elliotson proposed the establishment of a hospital in connection with University College of London he was vigorously opposed by his colleagues, condemned and ridiculed, but he was right and he won the fight. He advocated the use of the stethoscope and was again ridiculed and opposed, just imagine a physician today practicing without the use of a stethoscope. Boering[1] gives a vivid account about it. In 1837, Elliotson was professor of the practice of medicine at University College, London, and senior physician at the University College Hospital. For twenty years Elliotson had been a pioneer in medical science, distrustful of the old, but believing profoundly in the possibilities of the new. First, as physician at St. Thomas's Hospital, he gained consent to give clinical lectures. Later, he was appointed to University College and was largely instrumental in the establishment of the hospital in connection with the college. He was a man of great imagination, fertile in new ideas.

In the traditions of the past he saw mainly a force that prevents progress. But he was not a visionary, for many of his ideas were sound. The establishment of University College Hospital was one of these ideas. He saw what is accepted as obvious today, the fact that a medical school needs a hospital attached to it for demonstration and research. He was vigorously opposed in this venture by his conservative colleagues, but he won his fight. He was the first man in England to adopt the use of the stethoscope, which had been invented on the Continent. This practice his colleagues condemned, ridiculed or ignored. They spoke about his "hocus-pocus," and one is said to have remarked of the stethoscope, "Oh, it's just the thing for Elliotson to rave about!" Elliotson also introduced several novel practices in the use of drugs, practices which after the first resistance of the medical profession, have become established.

Until recent years the practice of physical therapy by any medical practitioners was frowned upon by organized medicine, but there were a few men with courage and convictions who held on to their ideals in spite of overwhelming odds, and what is the result. Recently the American Medical Association officially placed its stamp of approval upon the medical practice of physical therapy, and last year the Principals and Practices of Physical Therapy, in three volumes, was presented to the medical profession.

In recounting these historical facts we wish to point out that there is a lesson for both the reactionary and progressive elements. The reactionaries may learn that they can not hold down the progress of professional optometry forever, and the progressives may learn to stand up and fight for their ideals and convictions if their cause is right, just and sound. There is no power in the world that can stop their work for the advancement of the profession. J. I. K.

[1]Prof. E. G. Boering—A History of Experimental Psychology, p. 119.

PUPILLARY SIZE AS A MEASURE OF OCULAR FATIGUE

There are numerous factors which may contribute to the production of ocular fatigue. The word fatigue is used and abused now-a-days. We hear persons speaking of onset of ocular fatigue, equalization of fatigue, removal of fatigue. Upon listening to such statements one would think that ocular fatigue is something that can be measured objectively, like skiascopy, or at least subjectively, the fact, however, remains that science has as yet not discovered any reliable method for the measurement of ocular fatigue. Lukiesh and Moss[1] have recently reported a new technic which they have developed and utilized with some degree of success. They used the size of the pupil as a possible index of ocular fatigue. Their assumption was that the pupil will be more relaxed after several hours of constant work than before. They, accordingly, measured the size of the pupils before and after work (morning and afternoon), using an especially constructed instrument for that purpose. They found that the pupil dilated during the course of the day approximately 6 per cent in diameter and 13 per cent in area. From a statistical standpoint this increase is of importance. It was also noted that the pupils of all subjects showed a dilatation as the day progressed. It was also observed that not only does the pupil increase during the day but it also increases slowly from Monday to Saturday during the work week.

From this experiment they concluded that the pupil changes in size during the course of a day's work, and the change is in the direction of dilatation. This change, the authors claim, to be due to muscular fatigue rather than to retinal.

The technic for measuring the pupillary size is complicated and can at present only be carried out in a laboratory. It is to be hoped, however, that it will be so perfected soon so as to make it available for clinical usage.

J. I. K.

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BOOK NOTICES

OPTICS. By W. H. A. Fincham. Published by the Hatton Press Ltd., 72 Fleet Street, London, E.C. 4 England. 462 pages, 250 illustrations, 6 photographic plates, cloth cover. 1934.

In writing this book, "Optics," Fincham spared no time or labor to make it the most complete treatise on this subject. There have been

[1]M. Luchiesh and Frank K. Moss. Size of the Pupil as a possible index of ocular fatigue. American Journal of Ophthalmology. Vol. 16, 5, 1933.

published of late many books on Applied Optics, but most of these books devote the greatest portion of their contents to physical optics, which is not of much practical value to the student or to the refractionist. Fincham being a lecturer in applied Optics department at the Northampton Politechnic Institute at London avoided this mistake, because he knew from actual contact and experience what would be of most interest to the Optometrist as well as to the student. In fact the book is based upon lectures given by Fincham at the Institute.

The first eleven chapters deal with elementary Geometric Optics, the next four chapters with physical Optics, and the last three with advanced Geometric Optics. Having 250 illustrations, the book is profusely illustrated. There are a number of questions at the end of each chapter, covering the material contained in it. A list of answers to these questions is given at the end of the book.

It is the most complete and comprehensive textbook written on this subject and should be a welcome addition to the library of any Optometrist in the United States or England. J. I. K.

* * * * *

THE UNIVERSE OF LIGHT. By Sir William Bragg. Published by The Macmillan Co., New York, 283 pages, 108 illustrations, 24 plates, cloth cover. 1933. $3.50.

In the Universe of Light, Bragg gives an interesting account of how our modern knowledge has been built up over a period of years from the experiments and reasonings of men interested in the study of light.

Bragg is one of the most distinguished scientists in England. Amongst the many honors he received for his discoveries are the Order of Merit, the Noble Prize in Physics, the Bernard Gold Medal (Columbia University) and the Gold Medal of the Franklin Institute.

The most important portion of this book is a discussion about the two rival theories of light—the corpuscle and the wave theories associated respectively with Newton and Huygens.

His views on light are of special interest to the modern optometrist. Light, he claims, to be only a narrowly defined part of radiation in general. But the laws of optics are applicable over a wider range. The lengths of light waves fall between close limits, but the rules of the wave motion apply to the infinitesimal waves of the Roentgen rays on the one hand and to the long radio waves on the other. Bragg further contends that *radiations which are obviously corpuscular such as the showers of electrons, protons and atoms are found to obey in some measure the laws of light*. This statement is of particular interest to us because it upholds the statement repeatedly made in these pages by the reviewer that "light

electricity and electricity is light." It is of extreme importance to optometrists to have Mr. Bragg conform the modern views about the identity of light and electricity. This may mean the opening up of new opportunities for the optometrists to be of greater service to the public.

This book contains much experimental research material, and should prove of particular value to those interested in research problems.

J. I. K.

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THE 1934 YEAR BOOK OF THE NEW YORK STATE OPTOMETRIC ASSOCIATION. Edited by D. K. Uttal and B. G. Rosenkranz. Published at 2472 Broadway, New York City. 368 pages. $2. 1934.

As usual, this volume is a collection of short essays on subjects which will, perhaps, interest some optometrists. It is largely non-technical. Recommended as a substitute for light summer fiction for the weekends reading. C. C. K.

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PRACTICAL OPTOMETRY. L. Lester Beacher. Published by the Author at 227 East 57th Street. New York City. 163 pages. 1934.

Another frothy emission from the pen of Beacher. While it is true that this is better written than his previous work, this book contains nothing of value not already found in any Optical Primer. C. C. K.

"But my Practice *is at stake!*"

● Here was a man whose practice at one time had been the largest in his city. Then came the cut price era of the early '30's. Cheap competitors moved in. Believing it his only salvation, this man lowered prices too, only to find that there was no bottom and that as he cut his prices so he lost his patients.... He was in a desperate state of mind—ready to try anything. Perhaps that's why he gave the Riggs Representative such a cordial reception that day. Previously he had been opposed to Riggs on the grounds that it was "big business"—that we didn't care anything about him, as an individual. That's where he was wrong.... It so happened that the Riggs Representative had helped to straighten out a similar situation once before, but even if he hadn't he could have found some of the answers if there were any. Because it is highly improbable that any problem of any nature has not confronted at least one of our salesmen and the benefit of his experience is available to all the others. What's more, each Riggs salesman has the knowledge of the advertising, financial and technical departments at his disposal for offering suggestions to you.

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